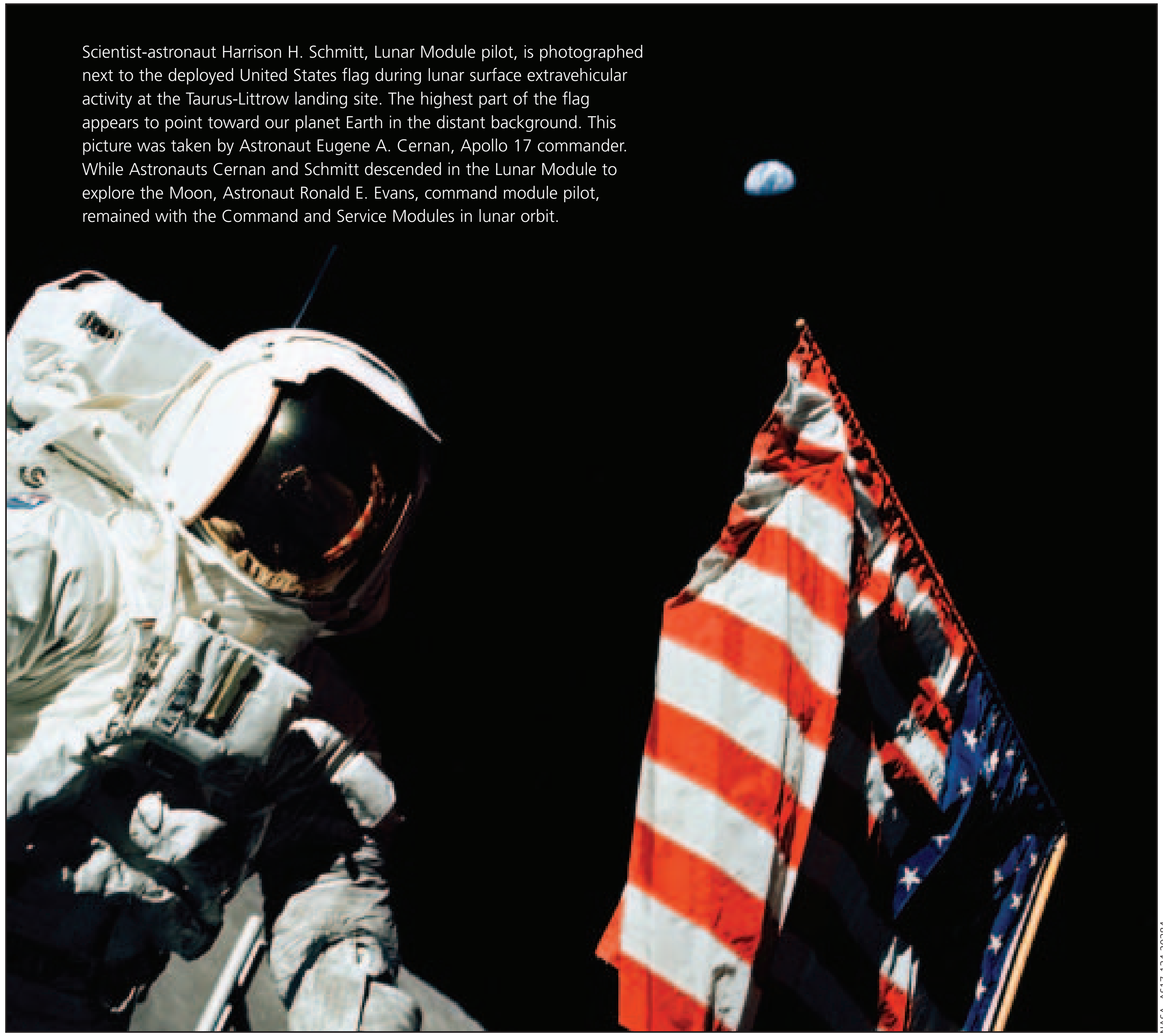
One giant leap for mankind



Scientist-astronaut Harrison H. Schmitt, Lunar Module pilot, is photographed next to the deployed United States flag during lunar surface extravehicular activity at the Taurus-Littrow landing site. The highest part of the flag appears to point toward our planet Earth in the distant background. This picture was taken by Astronaut Eugene A. Cernan, Apollo 17 commander. While Astronauts Cernan and Schmitt descended in the Lunar Module to explore the Moon, Astronaut Ronald E. Evans, command module pilot, remained with the Command and Service Modules in lunar orbit.

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Space Center Roundup

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Joanne Hale Editor
Kendra Phipps Assistant Editor
Marshall Mellard Graphic Designer

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Lyndon B. Johnson Space Center

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One small step for man...

"Here men from the planet Earth first set foot upon the Moon, July 1969 A.D. We came in peace for all mankind."

Quote from the plaque affixed to the Lunar Module and signed by Neil Armstrong, Michael Collins, Edwin (Buzz) Aldrin and President Richard Nixon.

35th anniversary coverage of the first Moon landing begins on page 12

July 2004

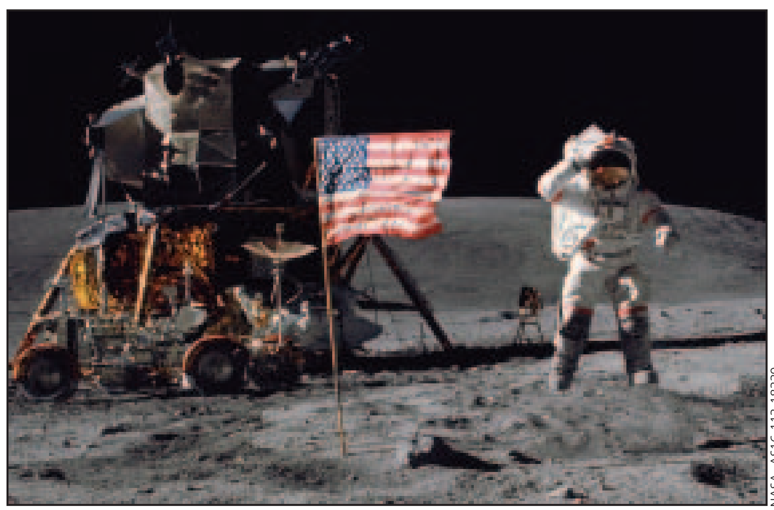
Houston, Texas

Special Guest...

A MESSAGE FROM ASTRONAUT JOHN W. YOUNG, APOLLO 16 COMMANDER

THE 35TH ANNIVERSARY of the Apollo 11 Moon landing is a good time to look at the past and think of the future. The Apollo lunar missions were building block missions. Every mission took all the techniques and procedures of the past missions and filled in their parts. In those days we all worked many hours around the clock to get the job done.

The Apollo 11 landing was indeed a giant leap for mankind. Mission Control team members came through with their knowledge that the software computer alarms were of no worry to the crew and allowed the landing approach to continue. When Neil took over the manual control and flew over the block field surrounding a large crater and then landed nearly out of fuel, we all were very thankful that he was successful. Many do not remember that after extra vehicular activity on the Moon, Neil and Buzz got a chance to sleep. Then, after igniting the Lunar Module's Ascent Stage engine to pick up the 6060.2 fps that Apollo 11 needed to get their rendezvous orbit, the single motor fired for almost 440 seconds. About three days later the Command Module splashed down in the Pacific, nose down. The crew got the Command Module up-righted and were hauled aboard the USS Hornet. Then, the rest of us could catch our breath. Neil, Buzz and Mike had performed an outstanding mission.


NASA AS16-113-18339

Astronaut John W. Young, commander of the Apollo 16 lunar landing mission, leaps from the lunar surface as he salutes the United States flag at the Descartes landing site during the first Apollo 16 EVA.

Even now, we are still just beginning. Now we have a new space vision. Civil service and contractor folks at JSC and all over the country will be busy developing the technologies we will need to get astronauts back to the Moon and on to Mars. What will those technologies be? Clearly, we will need heavy lift to put a lot of equipment on the Moon. Advanced ideas have looked at Shuttle derived launch vehicles that can put 100 metric tons to 150 nm in orbit. To live on the Moon we will need reliable advanced life support systems that will be 100 percent recycled food, water and waste. We will need to be able to terraform to grow crops such as vegetables and wheat. Large inflatable structures on the lunar surface will provide habitats – places to live and grow crops. We will need storm shelters to under one and one-half meters of regolith to protect us from the radiation of bad solar flares. The lunar base must be power rich. Reliable uninterruptible electric power is required. Initially, we believe uranium powered reactors can develop 300 kw inside a large garbage can generator. If, as some predict, the rims of some craters at the Moon's South or North Pole are in daylight nearly 100 percent of the time, solar arrays can provide electrical power. Design, development, test and checkout of the Crew Exploration Vehicle and the Lunar Landing Vehicle will be a big job. We worked that job for Apollo 11. Of course, we will require lightweight, high performance, comfortable, highly mobile pressure suits. Large inflatable-pressured rovers will greatly improve lunar surface exploration.

Although 35 years have passed since the Apollo 11 landing, the next 35 years with everyone busy at JSC are going to be even more spectacular.

John Young

REMEMBERING THE LEGACY OF

President Ronald Reagan

PRESIDENT REAGAN'S BOUNDLESS OPTIMISM about America manifested itself in many ways. Among them was his energetic and unbridled support for NASA's space exploration program. Less than three months after he took the oath of office, on April 12, 1981, the Space Shuttle *Columbia* launched on its first mission, and after a six-year hiatus, Americans were back in space to stay.

Following the initial successes of the Space Shuttle Program, space policy took on a new level of national importance in the Reagan Administration. In his 1984 State of the Union Address, President Reagan announced plans for a permanent human presence in space with the construction of a space station, and he tasked NASA to include the international community to be a part of a project designed for the benefit of everyone on Earth.


GPN-2000-001655

Today, the International Space Station orbits overhead as a living testament to the optimism and visionary leadership of this great man.

As President Reagan said, "Our progress in space, taking giant steps for all mankind, is a tribute to American teamwork and excellence. Our finest minds in government, industry and academia have all pulled together. And we can be proud to say: We are first; we are the best and we are so because we're free."

May God bless President Ronald Reagan. We are indebted to him for his visionary and persistent leadership. On behalf of all members of the NASA family, we offer our condolences to the Reagan family in their time of reflection on his contributions to them and, indeed, all Americans.

Sean O'Keefe
NASA Administrator

President Ronald Reagan's term saw triumph and tragedy for NASA – from the first Space Shuttle mission in 1981, to his 1984 call to develop a permanently crewed space station, to the 1986 Challenger *disaster. His moving tribute to the seven* Challenger *crewmembers inspired the nation.*

President Reagan also brought his sense of humor to NASA, as seen in this 1981 photo from Mission Control in Houston. Making an extremely long-distance call, the President jokingly asked Joe Engle and Richard Truly, the crew of the second Shuttle flight, if they could stop by Washington en route to their California landing site so that he could come along with them.

ROCK SOLID

JSC's lunar sample lab turns 25

by Bill Jeffs

NASA/Blair/DeHoyos JSC2004-00015

A researcher examines a lunar rock in JSC's Lunar Sample Laboratory Facility.

The lab technician very slowly opens the heavy, stainless steel door to the vault. This is no ordinary storage facility. It contains priceless national treasures – samples brought back from the Moon during the Apollo era.

The Lunar Sample Laboratory Facility in Building 31N at Johnson Space Center is NASA's chief repository for the invaluable lunar materials. The facility was dedicated on July 20, 1979, after two years of construction, and marks its 25th anniversary this month.

Between 1969 and 1972, six Apollo missions brought back 842 pounds of lunar rocks, core samples, pebbles, sand and dust.

The spaceflights returned 2,200 separate samples from six different exploration sites, and the samples are estimated to be 3.1 billion to 4.4 billion years old.

"These samples and their study represent the strong, continuing science legacy of Apollo," Dr. Carlton Allen, Manager of JSC's Astromaterials Acquisition and Curation Office said. "New generations of researchers are using new generations of instruments to study the lunar rocks and soils. The Apollo missions ended over 30 years ago but, thanks to these samples, we continue to better understand the solar system and our place in it."

A place to call home

Nobody imagined so much material would be returned. Before the Lunar Sample Laboratory Facility was built, lunar materials were stored in the Lunar Receiving Lab in Building 37 and in vaults across JSC. That earlier lab was large enough to process samples but too small to store them. Modifications made to Building 31 provided additional storage areas but still more space was needed.

Thus the idea for the construction of a new sample storage facility arose. But Congress would not authorize its construction until a remote site was found to store some of the samples. In the mid-1970s, an empty ammunition bunker at Brooks Air Force Base in San Antonio was selected. A vault was built inside the building to store some of the lunar samples. In 2002, those materials – about 14 percent of the collection – were moved to a secure building in White Sands, N.M.

Eighty percent of the 842-pound collection, most of it still in pristine condition, is stored in the Lunar Sample Laboratory Facility at JSC. The two-story, 14,000-square-foot facility provides permanent storage of the lunar sample collection in a physically secure and non-contaminating environment.

The facility is virtually indestructible yet has a basic structure. It features storage vaults that stand elevated above storm-surge sea level height to protect the samples from threats posed by hurricanes and tornadoes.

"The facility was incredibly well designed," said Dr. Gary Lofgren, curator of the Lunar Sample Laboratory Facility and a planetary scientist in JSC's Office of Astromaterials Research and Exploration Science (ARES). "There were several National Academy of Science members on the committee that laid out the science requirements for the building and reviewed designs to ensure their inputs were implemented. They thought of every contingency you can imagine to safeguard the samples."

Keeping it clean

The facility has exceeded expectations. The storage and processing areas in the lab were designed to be class 10,000 cleanrooms, allowing for 1,000 to 10,000 particles larger than .5 microns in each cubic foot of air space. Today the facility rarely has particle counts above 200.

"The concept of the building – to preserve samples with a high degree of integrity – has not been matched elsewhere," said Lofgren. "It is a one-of-a-kind facility in the world."

Members of JSC's Astromaterials Acquisition and Curation Office within ARES curate the lunar collection. They keep the collection in pristine condition, while making the samples available to approved scientists and educators.

Pristine lunar samples are stored and handled in stainless steel cabinets purged by high-purity nitrogen gas to minimize degradation of the samples. The nitrogen is continuously monitored for oxygen and moisture contents. Curators working in the lab wear three layers of gloves to keep their hands from touching the samples.

"The key to the cleanliness and preservation of the samples is the nitrogen environment and packaging the samples in that environment in multilayers," Lofgren said. "Since the samples are triply contained in sealed packages, even if the nitrogen environment were to fail, the integrity of the samples, at least for a short time, would not be compromised."

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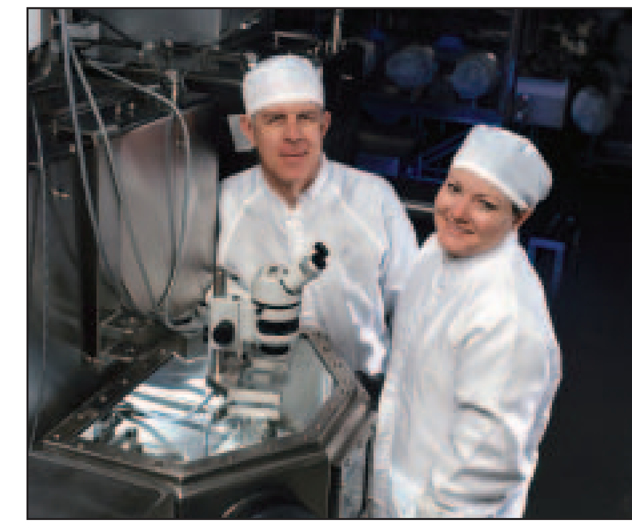

NASA/Blair/DeHoyos JSC2004-00018

Carlton Allen, astromaterials curator with NASA, works in the lab with Kathleen McBride, research scientist with Lockheed Martin.

NASA/Blair/DeHoyos JSC2004-00017

Charles Galindo, senior scientist with Lockheed Martin, and Mary Drake, curatorial administrative officer with NASA, are pictured working in the Lunar Sample Laboratory Facility.

Andrea Mosie, senior research scientist, and Jerome Hittle, laboratory assistant, examine lunar samples.

Samples subdivided for research projects are handled with specially cleaned tools and are sealed under nitrogen before being lent to science customers. The lunar collection now comprises about 100,000 subsamples. Some of them are securely stored in research laboratories and museums, the latter having about five percent of the collection on display.

Lunar learning

Interest in studying the samples remains high. The lab allocates 200 to 400 samples each year to scientists. Today about 90 active lunar principal investigators worldwide, mainly from the university community, have samples. Close to 60 groups worldwide have been actively requesting samples for the past decade.

While early studies focused on using the lunar samples to reconstruct the overall structure of the Moon, today scientists study the lunar samples for two primary reasons: to conduct comparative planetology studies and to take advantage of recent improvements in analytical instruments, primarily in the field of isotope geochemistry.

Isotope geochemistry involves studying the history of planets. When radioactive elements decay and change from one form of an element to another, they are called isotopes. Scientists study them to date and compare samples from the Moon, Mars or Earth.

"We now are convinced that we have samples from Mars from the meteorites that have come to Earth," Lofgren said. "We have samples from the Moon, and we have, of course, samples from Earth. We also have samples of meteorites that preceded the formation of the planets.

"By studying materials from these different entities, we have a better handle on how the solar system formed."

In addition, Lofgren said that "scientific instruments have improved tremendously in the last 30 years. Elements that were present in amounts too small to be analyzed in the early 1970s can now be studied."

Studies of lunar materials have played a key role in understanding the history of the solar system. Because the Moon is not geologically active like the Earth, the solar system's history is still easily seen on its surface. As a result, the Moon provides a unique glimpse into the system's early history.

Scientists also study lunar materials to learn about the Sun. Since the Moon has no atmosphere, all the particles given off by the Sun get trapped on the lunar surface, where they can later be studied.

Working in the Lunar Sample Laboratory Facility are Andrea Mosie; Carol Schwarz, staff research scientist; and Jerome Hittle, all with Lockheed Martin. (Inset) A close-up view of the lunar rocks contained in the second Apollo 11 sample return container.

Much has been learned about the Moon, but much more remains to be learned. Future return missions to gather more samples would be welcomed by scientists worldwide.

"We have samples from only six lunar sites," Lofgren said. "Just imagine if you had samples from only six places on Earth – there would be a lot you would not know about. Specifically, we still don't understand the full breadth of the evolution of the Moon. We need a broader range of samples to date to capture the history of the evolution of the planet."

Like scientists around the world, the Lunar Sample Laboratory Facility and its curators stand ready to receive any additional samples that may be returned. There are two missions on their way to return samples to Earth and to the facility: the Genesis mission will return particles expelled from the Sun in September, and the Stardust mission will return dust from a comet's tail in January 2006. A Japanese mission called Hayabusa will return samples from an asteroid and some of these samples will be brought to JSC's facility as well.

For more information on NASA's lunar samples and the lab, visit **http://curator.jsc.nasa.gov/lunar/lunar.htm**.